63-2-3

SAM-TDR-62-145

PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION

TECHNICAL DOCUMENTARY REPORT NO. SAM-TDR-62-145

December 1962

USAF School of Aerospace Medicine
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas

Task No. 775503

FOREWORD

This report was prepared in the Ear, Nose, and Throat Department, Audiology Laboratory, by—

LOIS L. ELLIOTT, Ph.D.

The author expresses appreciation to Alton Rahe of the Biometrics Department who directed the statistical analysis and to Airman Second Class John D. Beuchler, who completed much of the administrative work. Audiometric evaluations, on which the study is based, were carried out by several staff audiologists, among whom Harrell Sutherland and Roy Danford completed large portions of the work.

ABSTRACT

This study attempted to predict speech discrimination scores by using other audiometric test information. For two samples tested with Rush Hughes materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between SRT's in the test and nontest ears were the two best predictors of PB scores. The estimating equation (Rush Hughes) developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity coefficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect of nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc.

This technical documentary report has been reviewed and is approved.

Robert B. Payne

ROBERT B. PAYNE
Colonel, USAF, MSC
Chief, Operations Division

PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION

1. INTRODUCTION

Although speech discrimination testing is routinely used in audiologic evaluations, investigators have not concurred in their interpretation of the property being measured nor in its relationship to other hearing attributes. Nevertheless, the goal of predicting speech discrimination scores from other audiologic test measures persists since capability of reliable prediction would frequently render the procedure of speech discrimination unnecessary. Moreover, an understanding of the interrelationships between audiologic test measures would further the development of theories of hearing and listening.

Mullins and Bangs (2) approached prediction of speech discrimination scores by using multiple regression technics. In the design of their study, however, they included both ears of many subjects. Data reported below indicate that speech discrimination performance between ears is intercorrelated, suggesting that their statistical results may be spuriously high. Mullins and Bangs (2) also introduced a new quantity, the "masking index," which was intended to assess the effect of the audiogram configuration. This was computed by summing the differences between the threshold at one frequency and the thresholds of all lower frequencies. Although they found that the total masking index for 500, 1000, and 2000 cps correlated rather well with speech discrimination scores (.506), a study by Ross et al. (3) did not confirm this finding for speech discrimination in quiet. They found, however, that masking indices were somewhat better predictors of speech discrimination in noise.

Young and Gibbons (4), who have recently reviewed existing literature in this area and considered their own experimental results as well, have concluded that "analysis and interpretation of the data indicated insufficient relationship between speech discrimination scores and thresholds for speech reception and pure tones for the purpose of clinical prediction of speech discrimination test results."

Received for publication or .7 September 1962.

2. METHOD

The study reported in this paper was initiated early in 1961 before the papers by Young and Gibbons (4) and Ross et al. (3) were published. All available and potentially predictive information was utilized, including air and bone conduction scores, speech reception threshold (SRT), and age. Rather than computing masking indices, pure tone air conduction scores were utilized in a manner which emphasized the shape of the audiogram but did not introduce linear dependencies into the correlation matrix. Bone conduction scores were introduced to highlight the air-bone gap. Finally, several air conduction, interaction variables were included to explore previously unexamined relationships. It was hoped that this realignment of traditional audiologic variables might expose existing interrelationships.

Record cards for all patients seen in the Audiology Laboratory from 1959 through March 1961 were scanned to locate cases for which complete audiograms existed. Audiometric information required consisted of air conduction (AC) scores at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cps; bone conduction (BC) scores at 500, 1000, and 4000 cps; speech reception threshold (SRT); and speech discrimination (PB) score. In addition, test material used, and intensity at which the PB materials had been administered were required. Only the poorer ear was used for prediction in this study—a decision determined by comparing speech frequency averages for both ears. The information outlined above was recorded for the test ear selected as well as for the SRT and PB scores for the nontest ear.

All patients included in this study had been tested at the School of Aerospace Medicine, Audiology Laboratory, by trained and competent staff members, who used calibrated equipment and standardized procedures (oral response to PB lists). Speech discrimination testing was accomplished by use of disk-recorded W-22 or Rush Hughes (RH) speech materials. Because changes in equipment and staff personnel necessarily had occurred, the data of 1959 were treated as one group while data for 1960 and the first part of 1961 were considered separately (designated 1960 sample).

Patients' audiograms were categorized into four groups according to the following guide lines: To be considered as a perceptive loss, an ear was required to have a bone conduction score poorer than 15 db at some frequency and to have an AC-BC gap less than 15 db at 4000 cps. To be considered as having a conductive loss, an ear was required to have AC scores poorer than 15 db at some frequency, BC scores not poorer than 15 db at that frequency, and an AC-BC gap of at least 15 db at some frequency. Ears meeting both criteria were classified as having mixed hearing loss, while those meeting neither criteria were considered as having normal hearing. This schema appeared fairly adequate in classifying ears in a manner with which clinical judgment would concur. In a very few cases clinical judgment was solicited. Inadequate numbers of ears with conductive and mixed losses were identified. Table I lists the number of patients or ears assigned to each category for 1959 and for 1960. Groups marked with an asterisk were those for which the initial regression technics were developed, while those marked with a dagger (†) were groups to which the predictive equations were applied.

From the recorded test scores, a group of eighteen variables was generated. These are shown in table II. In some cases the score was used as it was recorded from the audiologic record card — i.e., X_1=air conduction score at 250 cps, X_{15}=SRT in the test ear, etc. The other variables were generated from information recorded on the audiologic test record card. For example, X_2 is the difference between the patient's hearing level at 500 cps and his hearing level at 250 cps in the test ear. If the hearing curve were flat in that region, regardless of extent of loss, the value of X_2 would be zero. Variables X_3 through X_7 were generated in a similar manner. Variables X_1 through X_7 combined contain all information of the usual air conduction curve; however, this information is expressed in a manner which emphasizes the shape of the curve. The AC-BC gaps at frequencies of 500, 1000, and 4000 cps are represented by X_8, X_9, and X_{10}. Variables X_{11}, X_{12}, and X_{13} are interaction variables included to determine whether the impact of the amount of change in hearing level between frequencies is influenced by the threshold value of the frequency at which the change begins. Thus, for variable X_{11}, the AC threshold at 1000 cps is multiplied by the difference between the thresholds for 2000 and 1000 cps. An audiogram showing a hearing level of 5 db for 1000 cps and 25 db for 2000 cps would have X_{11} equal to 100 $[5 \times (25 - 5)]$ while an audiogram with a hearing level of 20 db at

TABLE I

Number of ears in each category of hearing loss

Type of hearing loss	Word list	Number of ears	
		1959 Data	1960 Data
Perceptive	W-22	3	25*
Perceptive	Rush Hughes (RH)	36*	52*
Mixed	W-22	3	7
Mixed	RH	20†	20†
Conductive	W-22	2	2
Conductive	RH	1	8
Normal	W-22	2	1
Normal	RH	17†	15†

*Regression equation developed for this group.
†Regression equation applied to this group.

TABLE II

Variables of the analysis

X_1	Air conduction at 250 cps.
X_2	Air conduction at 500 cps minus air conduction at 250 cps.
X_3	Air conduction at 1000 cps minus air conduction at 500 cps.
X_4	Air conduction at 2000 cps minus air conduction at 1000 cps.
X_5	Air conduction at 3000 cps minus air conduction at 2000 cps.
X_6	Air conduction at 4000 cps minus air conduction at 3000 cps.
X_7	Air conduction at 6000 cps minus air conduction at 4000 cps.
X_8	Air conduction at 500 cps minus bone conduction at 500 cps.
X_9	Air conduction at 1000 cps minus bone conduction at 1000 cps.
X_{10}	Air conduction at 4000 cps minus bone conduction at 4000 cps.
X_{11}	Air conduction at 1000 cps × (air conduction at 2000 cps minus air conduction at 1000 cps).
X_{12}	Air conduction at 2000 cps × (air conduction at 4000 cps minus air conduction at 2000 cps).
X_{13}	Air conduction at 4000 cps × (air conduction at 8000 cps minus air conduction at 4000 cps).
X_{14}	PB score of nontest ear.
X_{15}	SRT of poorer (test) ear.
X_{16}	SRT of poorer (test) ear minus SRT of nontest ear.
X_{17}	Age
X_{18}	Intensity level of PB testing minus SRT (test ear).
Y	PB score of test ear (to be predicted).

1000 cps and 40 db at 2000 cps (same amount of change between the two frequencies) would show X_{11} equal to 400 $[20 \times (40 - 20)]$. Variables X_{12} and X_{13} were similarly determined. The difference between the SRT for the test ear and the SRT for the nontest ear is X_{16}. Since the test ear was chosen to be the poorer ear (on the basis of the SFA), this difference is positive in almost all cases. The level above the SRT at which the PB test was administered is represented by X_{18}. Standard procedure required that this difference was routinely 40 db; however, for patients with a severe loss who experienced recruitment and could not tolerate this level, a lower intensity was employed. Finally, Y represents the PB score in the test ear — the variable which was to be predicted.

Separate predictive equations for Y (PB score in test ear) were sought for each of three groups of perceptive loss subjects: (1) those tested with the RH List in 1959, (2) those tested with the RH List in 1960, and (3) those tested with the W-22 word list in 1960. These were the three groups with largest sample sizes.

3. RESULTS

The Wherry-Doolittle approach to multiple regression was used in an attempt to identify the variables which might, in linear combination form, most satisfactorily explain a large portion of the variability in the speech discrimination scores (1). Although this procedure does not necessarily produce the optimum combination of variables, it usually selects one of the better combinations. Squared multiple correlation coefficients (R^2) when all 18 predictor variables were employed were .93, .83, and .96 for the RH 1959, RH 1960, and W-22 groups, respectively (table III). This sets an upper bound on the level of prediction that might be anticipated with a smaller number of predictor variables. For both RH samples X_{15}, SRT in the test ear, was

TABLE III

Squared multiple regression coefficients (R^2) for different linear combinations of predictors of speech discrimination scores (subjects with perceptive losses)

Description of predictor variables	Sample: Rush Hughes 1959 N = 36 Predictor	R^2	Rush Hughes 1960 N = 52 Predictor	R^2	W-22 1960 N = 25 Predictor	R^2
1. All 18 predictor variables		.93		.83		.96
2. Best single predictor	X_{15}	.38	X_{15}	.37	X_{14}	.73
3. Two best predictors (Wherry-Doolittle)	X_{14}, X_{15}	.54	X_{14}, X_{15}	.56	X_{14}, X_1	.81
4. Three best predictors (Wherry-Doolittle)	X_{14}, X_{15}, X_{16}	.72	X_{14}, X_{15}, X_{16}	.70	X_{14}, X_1, X_{10}	.83
5. PB score of nontest ear	X_{14}	.32	X_{14}	.33	X_{14}	.73
6. Best common pair of predictors	X_{14}, X_{16}	.72	X_{14}, X_{16}	.70	X_{14}, X_{16}	.80
7. All predictors excluding X_{14}		.87		.68		.94
8. Best single predictor when X_{14} excluded	X_{15}	.38	X_{15}	.37	X_{11}	.29

the best single predictor of PB score ($R^2 = .38$ for RH 1959, $R^2 = .37$ for RH 1960). For the W-22 group, however, the best predictor was X_{14}, PB score in the nontest ear ($R^2 = .73$). For the two RH samples the Wherry-Doolittle procedures agreed in selecting the same two best predictors, X_{14} and X_{15} ($R^2 = .54$ for RH 1959, $R^2 = .56$ for RH 1960), and the same three best predictors, X_{14}, X_{15}, and X_{16} (X_{16} is the difference between SRT scores of test and nontest ears) ($R^2 = .72$ for RH 1959, $R^2 = .70$ for RH 1960). Since the additional predictive contribution of X_{15} (compared to prediction by X_{14} and X_{16}) was not significant at the .10 level, further identification of predictor variables was discontinued for these groups. In the W-22 sample, the two best predictors were X_{14} (contralateral discrimination score) and X_1 (X_1 is AC at 250 cps) ($R^2 = .81$) while the addition of X_{10} (AC-BC gap at 4000 cps) as the third predictor ($R^2 = .83$) selected by the Wherry-Doolittle technic did not contribute significantly. For all three samples, the squared multiple correlations using the three best predictors obtained by the Wherry-Doolittle technic were reasonably good (.72, .70, and .83) compared to the maximum values that might be expected. When other predictive combinations were explored, however, it was found that two predictors, X_{14} and X_{16} (PB score in nontest ear and difference between SRT's of test and nontest ears) produced equally good squared multiple correlations (.72 for RH 1959, .70 for RH 1960, and .80 for W-22). This is an example of a situation in which the two best predictors as selected by the Wherry-Doolittle method did not provide as good prediction as another choice of two predictors. It is particularly interesting that this occurred in both RH samples.

Several other sets of results are presented in table III, including the squared multiple correlations when all variables except X_{14} are utilized. The best single predictor, ignoring X_{14}, was found to be X_{11} for the W-22 sample. The predictive value of X_{14} alone is moderate in the RH samples ($R^2 = .32$ and $.33$) while it is fairly large ($R^2 = .73$) in the W-22 sample.

TABLE IV

Estimating equations for speech discrimination scores

Sample	Estimating equation	$\hat{\sigma}^2$	df
RH, 1959	$Y = .8815 + .9669X_{14} - .8210X_{16}$	97.2055	33
RH, 1960	$Y = 17.0406 + .7984X_{14} - .7319X_{16}$	85.6858	49
W-22, 1960	$Y = -3.9121 + 1.0298X_{14} - .2672X_{16}$	31.8609	22

Note: X_{14} is PB score for nontest ear. X_{16} is SRT test ear minus SRT nontest ear. Y is PB score for test ear.

Since contralateral speech discrimination score and difference between SRT's were found to have high predictive value for all three samples, predictive equations were developed separately for each sample by using these two variables. Resulting equations are shown in table IV. Statistical tests showed that the coefficient for X_{16} in the W-22 sample was significantly different from the equivalent coefficients in the other two samples (.01 significance level). Since there were no significant differences between coefficients or intercepts of the RH equations, data for these two groups were combined and one estimating equation was developed:

$$Y = 10.7795 + .8615\ X_{14} - .7483\ X_{16},$$

$$\sigma^2 = 92.555\ (85\ df)$$

This estimating equation was used to predict speech discrimination scores for subjects with mixed hearing loss and with normal hearing. The correlations between predicted and observed PB scores (table V) for the 1959 and 1960 groups with mixed hearing loss (.568 and .722) were significantly different from zero. Among the comparable coefficients for the two normal hearing groups, however, only the value for the 1960 group attained significance at the .10 level. There were not sufficient cases tested with the W-22 list among ears with normal or mixed hearing levels to attempt prediction.

TABLE V

Correlation between observed PB scores and scores predicted with combined RH estimating equation

Sample	Year	N	Correlation coefficient
Mixed RH	1959	20	.568*
Mixed RH	1960	20	.722†
Normal RH	1959	17	.395
Normal RH	1960	15	.496‡

*Significantly different from zero correlation, $P < .01$.
†Significantly different from zero correlation, $P < .001$.
‡Significantly different from zero correlation, $P < .10$.

When the data analysis reached this phase, a year had passed since the original selection of ears had been made from patients' files. It was possible, therefore, to select another sample of ears tested during the year that had elapsed, to categorize them into groups according to the original classification scheme, and to examine the relation between predicted and observed PB scores in an effort to validate the estimating equations. In this procedure all subjects for whom complete audiograms were available were considered as belonging to set A. Since the predictive equations did not require a complete audiogram, it was possible to include subjects for whom only partial information, including variables X_{14} and X_{16}, was available; these were designated as set B. As table VI indicates, only moderate success was achieved with this validation procedure. All observed correlation coefficients between predicted and observed PB scores are significantly different from zero. The coefficient for the W-22 sample (sets A and B combined to increase group size) was encouragingly high (.924). It should be noted that the W-22 estimating equation was used for this group, while the RH estimating equation was used in obtaining the other validity coefficients. Results for the perceptive loss, RH List, set B

TABLE VI

Correlations between predicted and observed speech discrimination scores for validation (1961) samples

Type of hearing loss	Word list	Set	N	r	P	95% Confidence limits
Perceptive	RH	A	43	.533	< .001	.27 — .72
Perceptive	RH	B	212	.374	< .001	.25 — .49
Perceptive	W-22	A B	10 9	.924	< .001	.81 — .97
Mixed	RH	A	14	.685	< .01	.24 — .89

group were disappointingly low ($r = .374$). However, when the difference between the mean PB score for RH 1960 group and the validation RH, set B group was examined, a difference was obtained which was significant at the .001 level. Although the ears in validation RH, set B group sustained a perceptive loss, their hearing level was considerably better than that of ears in set A (this difference was observed also in regard to $\bar{X}_{15}$), which was undoubtedly the reason that a complete audiometric workup had not been given. RH, set B group could, therefore, be eliminated from consideration as a validity sample. The correlation for the group with mixed hearing (.685) was approximately equivalent to that found in the 1959 and 1960 mixed hearing groups (table V). The validity coefficient for the RH, set A group was lower than anticipated (.533). The mean PB score (74.1) of the RH, set A group was significantly different ($P < .05$) from the mean of the combined 1959 and 1960 RH sample (69.4 — appendix, table A). Since the mean hearing levels and PB scores of the RH, set A validation sample were more similar to the 1960 RH sample than the 1959 data, the predictive equation that was developed for the 1960 data (table IV) was applied to the validation sample. The resulting value ($r = .531$) was almost identical to that obtained with the combined RH predicting equation ($r = .533$). Reasons for these lower validity coefficients among ears with perceptive loss are not clear. There may be undetermined differences between the ears in the groups on which the estimating equations were developed and the ears in the validating sample. Another possibility is that relationships observed in the 1959 and 1960 groups may have been spuriously inflated by chance factors. The immediate explanation for the lower R is that the correlations of both $\bar{X}_{14}$ and X_{16} with $\bar{Y}$ for the validation sample (shown in appendix) were considerably lower than for the original samples.

4. DISCUSSION

In evaluating these results one must conclude that utilization of the derived variables did not facilitate prediction of speech discrimination scores. In the 1960 W-22 sample variable X_{11} [(2000 — 1000) × 1000 AC] was selected as the single best predictor when X_{14} is excluded. With this exception, the derived scores do not play any prominent predictive role, thus bolstering the findings of other investigators concerning variables that do not predict PB scores.

These results contribute additional indication that speech discrimination among ears with perceptive loss is qualitatively different from that among normal ears. Estimating equations developed for the former group predicted poorly or failed to predict discrimination in normal ears. Prediction among ears with mixed loss was fair, presumably because of the perceptive component in these cases.

The most probable explanation for the large contribution of the contralateral discrimination score concerns the fact that a large number of features were common to this variable and the criterion measure. Although the two scores were obtained by administering test words to different ears, only one human being with associated intelligence, language ability, test-taking aptitude, etc., was involved. Further, any deviations in equipment calibration, ambient noise, or examiner bias would probably have applied to both ears. It appears that the contralateral discrimination scores may serve, in part, as a measure of the intrapatient and situational features affecting speech discrimination performance which are not routinely measured (e.g., patient intelligence and motivation) and which, in some cases, could be measured only with difficulty (e.g., examiner bias).

The large predictive contribution of X_{14} (contralateral discrimination score) suggests its use as a criterion in developing new speech discrimination materials. It would appear desirable to reduce the contribution of the X_{14} variable as much as possible while simultaneously increasing the contributions of other variables with more specific references. It would be interesting to determine whether measures such as general intelligence, verbal ability, difference in dialect between speaker and patient, and difference in dialect between patient and audiologist would markedly reduce the contribution of X_{14}. Another potential area of research would determine what characteristics of a PB list are most conducive to eliciting a substantial predictive loading of the contralateral discrimination score. Progress along these lines would contribute to understanding of what is measured by speech discrimination scores.

REFERENCES

1. Garrett, H. E. Statistics in psychology and education. New York: Longmans, Green and Co., 1953.

2. Mullins, C. J., and J. L. Bangs. Relationships between speech discrimination and other audiometric data. Acta Otolaryng. (Stockh.) 47:149-157 (1957).

3. Ross, M., D. A. Huntington, H. A. Newby, and R. F. Dixon. Speech discrimination of the hearing-impaired in noise: Its relationship to other audiometric parameters. (In preparation)

4. Young, M. A., and E. W. Gibbons. Speech discrimination scores and threshold measurements in a non-normal hearing population. J. Aud. Res. 2:21-33 (1962).

APPENDIX

TABLE A

Means and variances for three predictor variables and speech discrimination score

	N	$\bar{X}_{14}$	$\hat{\sigma}^2$	$\bar{X}_{15}$	$\hat{\sigma}^2$	$\bar{X}_{16}$	$\hat{\sigma}^2$	$\bar{Y}$	$\hat{\sigma}^2$
Perceptive loss									
1959 RH	36	76.9	175.4	22.3	394.1	8.2	200.4	68.5	323.5
1960 RH	52	75.9	142.4	18.6	339.1	10.5	188.1	70.0	272.2
1961 RH, A	43	77.8	44.0	13.8	190.6	8.2	140.8	74.1	95.2
1961 RH, B	212	79.6	27.9	−2.0	34.1	1.3	12.5	78.2	40.2
1960 W-22	25	89.1	113.7	26.3	236.1	10.7	150.5	85.1	142.8
1961 W-22, A	10	75.4	304.9	27.2	468.4	3.9	29.7	72.6	619.6
1961 W-22, B	9	93.6	17.8	−0.4	67.0	0.9	8.6	89.1	17.1
Mixed loss									
1959 RH	20	77.1	172.0	45.2	168.5	23.5	338.4	71.5	137.6
1960 RH	20	74.7	91.1	42.8	473.2	23.0	315.1	59.7	396.8
Normal									
1959 RH	17	81.0	337.8	7.5	485.5	9.3	393.0	83.2	35.5
1960 RH	15	80.8	31.3	0.5	26.1	3.1	20.3	80.7	26.1

TABLE B

Intercorrelation matrix for 1959 RH perceptive loss sample

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	Y
X_1	99	04	−20	−47	−25	−10	−17	35	18	07	06	−05	22	08	69	56	06	−43	−42
X_2		99	−22	−10	−41	−28	−09	44	−05	−15	23	−10	−03	−10	50	25	10	−40	−15
X_3			99	22	−01	−14	10	−49	−22	19	52	23	12	−41	14	−23	10	−07	−28
X_4				99	09	−03	27	−22	−12	52	31	68	−28	−43	−22	−26	−17	26	−25
X_5					99	07	−18	−42	−29	−14	−10	17	−40	−07	−44	−14	−15	24	00
X_6						99	30	−06	33	04	−26	24	−02	22	−29	01	09	38	28
X_7							99	08	03	06	09	30	55	12	01	11	17	08	14
X_8								99	45	21	−18	00	05	13	25	23	−08	04	12
X_9									99	21	−13	08	−12	16	−04	−04	−16	25	32
X_{10}										99	30	59	−10	−46	07	−07	10	17	−34
X_{11}											99	36	19	−54	44	11	33	−35	−58
X_{12}												99	−22	−44	07	09	01	23	−44
X_{13}													99	19	30	19	51	−32	07
X_{14}														99	−30	23	−14	27	57
X_{15}															99	56	20	−73	−62
X_{16}																99	07	−30	−49
X_{17}																	99	−35	−06
X_{18}																		99	34
Y																			99

Note: Decimal points have been omitted.

TABLE C

Intercorrelation matrix for 1960 W-22 perceptive loss sample

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}
X_1	99	−09	−42	−13	−34	−40	−01	−05	−20	−06	26	−16	−04	−21	71	47	−10	−49	−47
X_2		99	05	−24	−32	−04	09	20	24	−02	−04	10	33	23	41	25	30	−17	24
X_3			99	08	−06	−16	06	21	−04	15	18	02	14	−37	01	−13	−15	19	−18
X_4				99	−21	−38	00	−31	−25	14	60	02	−20	−30	−08	−37	07	16	−18
X_5					99	36	07	−06	−03	56	−21	39	−13	14	−45	−14	08	38	18
X_6						99	−08	−08	09	00	−56	31	13	35	−55	−22	20	42	45
X_7							99	06	−23	34	24	−14	56	−23	21	02	10	−02	−13
X_8								99	34	−01	−24	02	−02	37	−08	29	−18	−22	39
X_9									99	−31	−18	−27	03	50	−34	−08	−15	21	40
X_{10}										99	38	41	06	−31	14	−17	20	16	−11
X_{11}											99	−15	07	−60	40	−22	−10	−05	−53
X_{12}												99	01	05	−03	02	38	41	05
X_{13}													99	05	27	−16	34	04	01
X_{14}														99	−34	25	01	00	85
X_{15}															99	46	08	−50	−48
X_{16}																99	−25	−32	−05
X_{17}																	99	00	06
X_{18}																		99	06
X_{19}																			99

Note: Decimal points have been omitted.

TABLE D

Intercorrelation matrix for 1960 RH perceptive loss sample

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}
X_1	99	14	−27	−32	−14	−34	05	46	15	10	−28	18	26	−07	78	67	−10	−56	−40
X_2		99	27	08	−35	−16	−14	15	02	16	13	26	04	−39	57	26	14	−43	−37
X_3			99	14	−31	−28	15	−29	02	15	45	−13	20	−15	24	01	07	−09	−16
X_4				99	01	−16	−04	−20	−03	34	63	46	−13	−34	−09	−10	22	03	−22
X_5					99	14	−06	−04	07	−03	−13	10	−41	14	−30	−14	11	24	05
X_6						99	−21	−12	08	19	−08	−09	−14	09	−47	−33	20	23	22
X_7							99	04	07	−10	16	01	54	−11	09	09	−08	13	−09
X_8								99	37	19	−33	20	−06	04	28	32	05	−28	−11
X_9									99	42	−01	20	04	−04	07	01	26	−01	−14
X_{10}										99	42	36	14	−31	24	22	36	−24	−45
X_{11}											99	17	18	−25	04	01	20	00	−22
X_{12}												99	−01	−32	24	20	37	−23	−46
X_{13}													99	−21	32	21	−18	−01	−24
X_{14}														99	−25	01	−25	29	57
X_{15}															99	71	00	−69	−61
X_{16}																99	−17	−43	−60
X_{17}																	99	−08	−28
X_{18}																		99	43
X_{19}																			99

Note: Decimal points have been omitted.

TABLE E

Intercorrelation matrix for 1961 RH, set A perceptive sample

	Variables			
	X_{14}	X_{15}	X_{16}	Y
X_{14}	.99	−.35	.17	.30
X_{15}		.99	.52	−.54
X_{16}			.99	−.39
Y				.99

USAF School of Aerospace Medicine, Brooks AF Base, Tex.

SAM-TDR-62-145. PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION. Dec. 62, 13 pp. incl. 6 tables, 4 refs., app.

Unclassified Report

This study attempted to predict speech discrimination scores by using other audiometric test information. For two samples tested with Rush Hughes materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between SRT's in the test and nontest ears were the two best

1. Otolaryngology
2. Audiology
3. Speech discrimination

I. AFSC Task No. 775503
II. Elliott, L. L.
III. In ASTIA collection

USAF School of Aerospace Medicine, Brooks AF Base, Tex.

SAM-TDR-62-145. PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION. Dec. 62, 13 pp. incl. 6 tables, 4 refs., app.

Unclassified Report

This study attempted to predict speech discrimination scores by using other audiometric test information. For two samples tested with Rush Hughes materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between SRT's in the test and nontest ears were the two best

1. Otolaryngology
2. Audiology
3. Speech discrimination

I. AFSC Task No. 775503
II. Elliott, L. L.
III. In ASTIA collection

USAF School of Aerospace Medicine, Brooks AF Base, Tex.

SAM-TDR-62-145. PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION. Dec. 62, 13 pp. incl. 6 tables, 4 refs., app.

Unclassified Report

This study attempted to predict speech discrimination scores by using other audiometric test information. For two samples tested with Rush Hughes materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between SRT's in the test and nontest ears were the two best

1. Otolaryngology
2. Audiology
3. Speech discrimination

I. AFSC Task No. 775503
II. Elliott, L. L.
III. In ASTIA collection

USAF School of Aerospace Medicine, Brooks AF Base, Tex.

SAM-TDR-62-145. PREDICTION OF SPEECH DISCRIMINATION SCORES FROM OTHER TEST INFORMATION. Dec. 62, 13 pp. incl. 6 tables, 4 refs., app.

Unclassified Report

This study attempted to predict speech discrimination scores by using other audiometric test information. For two samples tested with Rush Hughes materials and one sample tested with W-22 materials, PB score in the nontest ear and difference between SRT's in the test and nontest ears were the two best

1. Otolaryngology
2. Audiology
3. Speech discrimination

I. AFSC Task No. 775503
II. Elliott, L. L.
III. In ASTIA collection

predictors of PB scores. The estimating equation (Rush Hughes) developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity coefficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect of nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc.

predictors of PB scores. The estimating equation (Rush Hughes) developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity coefficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect of nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc.

predictors of PB scores. The estimating equation (Rush Hughes) developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity coefficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect of nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc.

predictors of PB scores. The estimating equation (Rush Hughes) developed on these samples was applied to groups with normal hearing (very poor prediction) and mixed losses (moderately good prediction). Application of the equations to cross-validation samples indicated high validity coefficients for the W-22 equation, but only moderate validity coefficients for the RH equation. Results suggest that the predictive contribution of PB score in the nontest ear includes the effect of nonmeasured variables such as subject's verbal aptitude, motivation, difference between speaker's and listener's dialects, etc.